

**DRAFT
ENVIRONMENTAL
IMPACT
STATEMENT**

CONTINUED

E N V I R O N M E N T A L C O N S E Q U E N C E S

SUMMARY OF MANAGEMENT ALTERNATIVES

ALTERNATIVE A

CONCEPT

- Emphasis on preservation of the islands' natural and cultural resources
- Visitors encouraged to discover nature and history along routes described and laid out by park managers
- Adventurous nature of park visits; exploring nature and history on islands
- Some visitors prefer to view the islands from a boat or remain at mainland portions of the park
- Island visitors find abundant opportunities for solitude

MANAGEMENT AREAS

Potential Mainland Gateways

- Downtown Boston, Hingham, Lynn (existing)
- Hull, Quincy, Dorchester, Seaport, Charlestown, East Boston, Winthrop, Revere, Salem (potential)

Areas of Special Uses

- Deer and Nut (wastewater treatment facilities)
- Long and Moon (social service and public safety facilities)
- Thompson Island (educational campus)
- Nix's Mate (navigation marker)

Visitor Services and Park Facilities Emphasis

- "Hubs": Spectacle, George's
- Visitor center and food service
- Highest concentration of visitors on these islands
- Facilities located close to the pier

Areas of Historic Preservation Emphasis

- Around forts and fortifications of George's, Long, Lovell's, Peddock's
- Lighthouses of The Graves, Long, and Little Brewster
- Granite wastewater treatment structures of Moon

Areas of Managed Landscape Emphasis

- Gallop's, Grape, Bumpkin, Webb State Park
- Portions of Deer, Nut, Spectacle, Long, Peddock's, Lovell's, Thompson, World's End

ALTERNATIVE B

- Park is background or setting for variety of recreational opportunities that meet diverse interests of visitors
- Becomes well-known recreation area in metropolitan Boston
- Open-ended, unstructured experiences on the harbor and the islands; some elements not specifically related to the resources of the Boston Harbor Islands
- Visitors encouraged to try various programs, learn some natural and cultural history of the islands.
- Visitors experience park as busy, highly active place

Same as Alternative A

Same as Alternative A

- "Hubs": Spectacle, George's, Peddock's, Long, and Deer
- Visitor centers or contact stations, food services, venues for concerts or other events spread beyond immediate vicinity of pier
- Variety of attractions

- Around forts and fortifications of George's, Long, Lovell's
- Lighthouses on The Graves and Little Brewster

- Grape, Bumpkin, Gallop's, Rainsford, Great Brewster, Calf, Langlee, Webb State Park
- Portions of Deer, Nut, Spectacle, Long, Peddock's, Lovell's, Thompson, World's End

ALTERNATIVE C, THE PREFERRED ALTERNATIVE

- Increased opportunities for visitors to discover the natural and cultural history of Boston Harbor Islands with strong emphasis on preservation of resources
- Park managers provide visitors with creative, educational, and entertaining programs that provide meaning and bring resources alive
- Visitor programs focus attention and programs on cultural and natural history
- Partnership instills in visitors stewardship of resources; visitors return repeatedly to enjoy creative activities revolving around island resources

Same as Alternative A

Same as Alternative A

- “Primary Hubs”: Spectacle, George’s, Peddock’s
- “Secondary Hubs”: Long, and Deer (if sufficient ferry service demand)
- Visitor facilities concentrated close to the pier
- Visitor centers or visitor contact stations, restaurants or food concessions, boat rentals, small venues for events like concerts, historical pageants, and educational presentations.

- Around forts and fortifications of George’s, Long, Lovell’s, Peddock’s
- Lighthouses at Graves, Little Brewster, Long
- Granite structures on Moon

- Grape, Bumpkin, Gallop’s, Great Brewster, Rainsford, Webb State Park
- Portions of Deer, Nut, Spectacle, Long, Peddock’s, Lovell’s, Thompson, World’s End

NO-ACTION ALTERNATIVE

- Under no-action alternative no unifying concept joining all islands and managers
- Boston Harbor Islands State Park in 1986 plan says, “The islands themselves are the basis of the plan. Concepts of each island are based on their individual assets and liabilities, and the plan...is organized around four interrelated themes: natural forces, harbor geography, harbor history, and harbor transportation-- that give coherence to the Boston Harbor Islands State Park as a whole.”
- The state park encompasses 18 of the 30 islands in the national park area.

Under the current system management areas are not designated.

ALTERNATIVE A

Areas of Managed Landscape Emphasis (continued)

- Gallop's, Grape, Bumpkin, Webb State Park
- Portions of Deer, Nut, Spectacle, Long, Peddock's, Lovell's, Thompson, World's End

Areas of Natural Features Emphasis

- Outer Brewster, Middle Brewster, Green, Little Calf, Shag Rocks, Snake, Sheep, Hangman, Raccoon, Rainsford, Slate, Sheep, Raccoon, Hangman, Snake, Ragged, Langlee, Sarah, Button
- Portions of World's End, Peddock's

RESOURCE PROTECTION

- Natural and cultural resources monitored to avert overuse
- Critical or sensitive natural resources receive special emphasis
- Historic landscapes on Thompson and World's End preserved and managed
- Partnership prepares and maintains resource management plan to perpetuate park natural resources and physical and biological processes
- Plan includes monitoring, inventory, research, mitigation, interpretation of resources, and visitor-protection activities; also program activities to identify, evaluate, treat, and provide for public understanding and enjoyment of cultural resources
- Cultural resources preserved according to the Secretary of the Interior's standards for treatment of historic properties
- Actions guided by policies described in Goals and Policies section
- Responsibility assumed by each managing agency

Natural Resources

- Some islands regarded unofficially as wilderness: nature allowed to take over, no visitor facilities
- Invasive plants reduced; revegetation on some islands
- Trails developed and maintained to keep visitors from compacting soil
- A few small boardwalks through portions of salt marshes
- At Peddock's, landscape rehabilitated after cottages evaluated and removed
- Islands with disturbance-sensitive species closed to visitors during nesting and fledging seasons; other areas closed or restricted to protect threatened and endangered species
- Brewsters, except Little Brewster, open for primitive camping
- Boat tours focus on awareness of habitat values

ALTERNATIVE B

- Grape, Bumpkin, Gallop's, Rainsford, Great Brewster, Calf, Langlee, Webb State Park
- Portions of Deer, Nut, Spectacle, Long, Peddock's, Lovell's, Thompson, World's End

- Outer Brewster, Middle Brewster, Green, Little Calf, Shag Rocks, Snake, Sheep, Slate, Hangman, Raccoon, Ragged, Sarah, Button
- Portions of Peddock's, Thompson

Same as Alternative A

- Small islands (Snake, Sheep, Green, Calf, Little Calf, Hangman), may be highly restricted to protect habitat
- Many trails to accommodate visitors on most islands
- Extensive boardwalks built through salt marshes
- Vegetation management to enhance visitor access

ALTERNATIVE C, THE PREFERRED ALTERNATIVE

NO-ACTION ALTERNATIVE

- Grape, Bumpkin, Gallop's, Great Brewster, Rainsford, Webb State Park
- Portions of Deer, Nut, Spectacle, Long, Peddock's, Lovell's, Thompson, World's End

- Outer Brewster, Middle Brewster, Green, Calf, Little Calf, Shag Rocks, Snake, Sheep, Hangman, Raccoon, Slate, Langlee, Ragged, Sarah, Button, Portions of Peddock's, Thompson

Same as Alternative A

- Snake, Sheep, Hangman, Green, Calf, Little Calf, Middle Brewster, Outer Brewster closed (or seasonally restricted) to protect habitat or nesting sites of wildlife disturbed by human presence
- Invasive plants in designated places reduced; revegetation
- Vegetation managed for habitat health, to maintain established views, to open up new views
- Trails developed and maintained to keep visitors from compacting soil
- Boardwalks through salt marshes.
- Effort to engage public in stewardship of resources

- Resource protection strategies vary according to agency practices

- Nature allowed to take over on some islands with no visitor amenities; little reduction of invasive plant species
- Some revegetation; little plant restoration

ALTERNATIVE A

CULTURAL RESOURCES

- Management emphasis on preservation and rehabilitation
- Historic structures reports for the most important resources
- Sensitive archeological sites may be closed to visitors
- Sea walls repaired where important cultural resources threatened.

Carrying Capacity

- Visitor management plans developed using Visitor Experience and Resource Protection process (scientific analyses) for each management area and applied to each island
- Partnership agencies continue employing existing administrative carrying capacities until new scientific ranges established parkwide, or unless significant damage to resources evident due to overuse

RESEARCH AND INFORMATION

- Partnership would encourage needed scholarly and scientific research, disseminate findings, use findings as basis for resource protection and visitor use management
- Highest priority on inventory and monitoring program for natural and cultural resources, including vegetation and shoreline surveys, historic structures reports for major structures, historic resource studies, cultural landscape studies of certain islands, archeological investigations, and ethnographic studies with emphasis on American Indian tribes
- An electronic clearinghouse maintained by the NPS
- Expansion of existing NPS geographic information system database for resource protection and visitor use patterns analysis
- Actions guided by policies described in Goals and Policies section
- Priorities for studies on those that lead to increased protection of resources and on the feasibility of re-establishing some native species

ALTERNATIVE B

- Management emphasis on modification of some resources to serve visitors
- Historic structures reports for threatened structures
- Sea walls repaired to serve visitors and protect threatened important cultural resources

Same as Alternative A

- Visitor use managed and potentially limited, using indicators that favor resource conditions.
- Increases in number of visitors on islands lowest in this alternative

Same as Alternative A

- Priorities for studies on those that meet visitors' needs

ALTERNATIVE C, THE PREFERRED ALTERNATIVE

NO-ACTION ALTERNATIVE

- Management emphasis on preservation or rehabilitation; stabilization as interim treatment
- Historic structures reports for most important resources
- Sea walls repaired where important cultural resources threatened.

- Secretary of the Interior's standards applied to major cultural resources
- Cultural resource management stabilizes some structures and restores some structures, but many structures continue to deteriorate

Same as Alternative A

- Visitor use managed and potentially limited, using indicators that favor visitor experience in developed areas of hub islands and indicators that favor resources elsewhere.
- Increases in number of visitors on islands nearly as high as in Alternative B

- Visitation most likely stays at current levels, approximately 150,000

Same as Alternative A

- Priorities for studies on protection of resources in the areas of greatest visitor concentration, on the hub islands

- Most research continues by outside researchers in variety of institutions and agencies, without parkwide coordination

ALTERNATIVE A

VISITOR ACCESS, USE, AND ENJOYMENT

- Park identity, marketing programs (logo, park signage system, directional signage, etc.) developed
- System of mainland information kiosks, wayside exhibits, other interpretive media to orient visitors at ferry
- Water shuttles from hub islands
- Increase in number of visitors, but not equally distributed throughout
- Few visitors on some islands, many on others
- Islands with regular shuttle boat service have park ranger staff, guided tours, self-guided tours, locational signs, interpretive signs, composting toilets
- Hub islands have potable water, toilets, food service, staff
- Islands with camping have potable water, composting toilets
- Cooperative arrangements with relevant law enforcement agencies for protection of visitors
- Actions guided by policies described in Goals and Policies section
- Numerous opportunities to learn about the islands on tour boat or at mainland visitor center without being on the islands; thus, some visitation increase occurs on boats rather than islands
- Interpretive programs with park ranger and mobile exhibits aboard ferries
- Exhibits and other interpretive media based on cultural and natural resources
- Activities such as picnicking, hiking, exploring historic ruins, swimming, sailing, and kayaking would be allowed in certain areas
- Islands served by excursions but not water shuttle have few amenities
- Remote islands have no visitor services; nature takes over
- Some fragile islands, such as Snake, Sheep, Green, Calf, Little Calf, and Hangman, closed or highly restricted to protect habitat

Transportation

- Water transportation system provides access for most visitors
- Islands connected to mainland (except World's End) generally do not receive many visitors by land
- Mainland gateway areas developed in response to demand and infrastructure requirements
- Ferries travel from mainland gateways to hub islands, where water shuttles operate in loops to several other islands
- Excursions to certain islands might operate from mainland gateway or hub islands
- Private water taxi service available on call
- Ferries operate frequently in summer, less frequently in spring and fall; special excursions in winter

ALTERNATIVE B

Same as Alternative A

- Emphasis on island programs, recreational activities. Most visitors go onto islands
- Ferries and water shuttles run frequently, allow visitors to island-hop, have range of experiences in single day
- Emphasis on visitors taking part in activities on islands without advance itinerary
- Activities such as picnicking, hiking, exploring historic ruins, swimming, sailing, and kayaking encouraged
- Equipment rentals and instruction for water sports
- Visitor access to most islands including Brewsters; piers, interpretive media, basic toilet facilities
- Remote islands have occasional excursions in small boats with rangers; composting toilets, shade shelters, cooking grills, etc. may be provided

Same as Alternative A

ALTERNATIVE C, THE PREFERRED ALTERNATIVE

Same as Alternative A

- Emphasis on providing advance visitor information
- Visitors encouraged to plan itinerary from brochures, web sites, and staff at gateway kiosks before embarking on island trip; choices of activity and choices of island
- Activities such as picnicking, hiking, exploring historic ruins, swimming, sailing, and kayaking encouraged
- Equipment rentals and instruction for water sports
- Remote islands have no visitor services; nature takes over
- Some fragile islands, such as Snake, Sheep, Green, Calf, Little Calf, and Hangman, closed or highly restricted to protect habitat

Same as Alternative A

NO-ACTION ALTERNATIVE

- No parkwide interpretive themes
- Individual managing agencies continue to emphasize their own island-specific themes
- Exhibits and other interpretive media based on islands' cultural and natural resources
- Information about the islands handled more or less individually rather than through coordinated public information system

- Access to six open state park islands is contracted ferry and water shuttle
- Islands outside state park not included in the water transportation system
- Occasional excursions bring visitors to Little Brewster and other islands for natural and historical programs

ALTERNATIVE A

- Transportation system operated by private boat operators under contract to the Partnership or member agencies
- Responsibility for dock management held by the island managing agencies
- Transportation system monitored, evaluated, and adjusted as needed
- Water shuttles make circuits on regular schedule several times daily among George's, Spectacle, Gallop's, Lovell's, Grape, Bumpkin, and Peddock's
- Less frequent water shuttle schedule to several other islands where visitor programs would be available
- Some islands reached by small craft in organized excursions, including Great Brewster, Rainsford, Nut, World's End, Thompson, and Little Brewster

EDUCATION AND INTERPRETATION

- Comprehensive interpretive sign program
- Guided tours available routinely in daytime during summer season
- Seasonal programs and interpretive tours run from gateways and islands
- Before ferry trip visitors learn about park through system of mainland information kiosks, wayside exhibits, and other interpretive media
- Areas of emphasis derived from park themes; include ecology and geology of the harbor, role of the islands in coastal protection
- Educational programs, interpretive waysides throughout the island system raise public awareness about presence, culture, and history of American Indians
- Emphasis on King Philip's War period and American Indians' understanding of nature and ecology; relationship to the universe
- Programs on several islands designed and led by American Indians
- Curriculum-based programs developed through Partnership and Advisory Council for regional and national audiences
- Facilities with contemporary uses on the islands, such as the wastewater treatment plant, would have visitor interpretive programs
- Actions guided by policies described in Goals and Policies section
- Visitor programs developed around natural and cultural resources of the islands
- American Indian interpretive center developed on one island
- Environmental education programs on many islands offer intensive learning activities for schools
- Broad outreach programs to educational institutions

ALTERNATIVE B

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- Water shuttles make circuits several times a day to some islands, less frequently to others depending on demand. Islands may include George's, Spectacle, Gallop's, Lovell's, Grape, Bumpkin, Deer, Nut, Great Brewster, Rainsford, World's End, Thompson, and Little Brewster.
- Some remote islands may occasionally be visited by small craft in organized excursions.

Same as Alternative A

- Visitor programs emphasize participatory activities for visitors based on island environment; not always tied to island resources
- Large-scale events such as pageants of Civil War encampments, sound-and-light shows, theatre, and concerts

ALTERNATIVE C, THE PREFERRED ALTERNATIVE

NO-ACTION ALTERNATIVE

- Water shuttles make regular circuits once or several times daily among George's, Spectacle, Deer, Gallop's, Lovell's, Grape, Bumpkin, and Peddock's
- Rainsford, World's End, and Thompson might have less frequent boat service
- Great Brewster and Little Brewster accessible by organized excursions.

Same as Alternative A

- Visitor programs developed for George's, Lovell's, Gallop's, Grape, Bumpkin, Deer, and Worlds End
- Programs developed for Spectacle Island for opening in 2002

- Visitor programs developed around natural and cultural resources of the islands
- American Indian interpretive center developed on one island
- Environmental education programs on many islands offer intensive learning activities for schools
- Interpretation on several islands focus on contemporary uses on the islands, such as wastewater treatment facilities
- Events such as pageants of Civil War encampments, sound-and-light shows, theatre, and concerts

ALTERNATIVE A

MANAGEMENT AND OPERATIONS

- Islands managed by existing managers with overall policy established by Boston Harbor Islands Partnership
- Each island open to the public has resource protection, interpretive, maintenance, and administrative staff necessary to maintain parkwide standards
- Coordination among island managers would be done by the Boston Harbor Islands Partnership, operating largely through committees
- Staff support for Partnership and Advisory Council provided primarily by NPS; support by Partnership agency personnel as available
- Actions guided by policies described in Goals and Policies section

Potential Facility and Infrastructure Changes

- Facilities improved to meet high quality standards and unify park visually and thematically
- New infrastructure guided by environmentally sensitive philosophy and infrastructure development guidelines
- Development supports park goals
- Possible infrastructure changes:
 - handicapped-accessible piers
 - visitor contact stations or visitor centers
 - sales of park-related items
 - installation of utilities (water, electricity, communications, waste-disposal, heat) in certain areas
 - American Indian cultural center
 - environmental education center
 - camp sites
 - administrative facilities
 - maintenance facilities
 - staff housing
 - toilets
 - shade shelters
 - rehabilitation (adaptive re-use) of historic structures
 - removal of selected deteriorated structures
 - restoration of natural landscapes
 - rehabilitation of cultural landscapes
 - trails and boardwalks
 - interpretive media
 - boat moorings
 - rental facilities for water sports
- Improvements emphasize protection of park resources
- Major facilities concentrated on two islands, George's and Spectacle
- Minimal facilities developed on islands in natural resources management areas
- Examples of possible changes:
 - redesigned entrance at George's, with rehabilitation of visitor center and historic landscape
 - restoration of selected missing features of Fort Warren
 - restoration of landscapes on portions of several islands
 - adaptive re-use of several buildings of Fort Andrews
 - installation of boardwalks in portions of salt marshes

ALTERNATIVE B

Same as Alternative A

Same as Alternative A

- Improvements emphasize activities for visitors.
- Major visitor facilities and services on George's, Spectacle, Peddock's, Long, Deer
- Attractions at hubs may have elements not specifically related to resources of Boston Harbor Islands
- Examples of possible changes:
 - Peddock's possibly a major visitor destination, with rehabilitated and adaptively re-used Fort Andrews with lodgings, restaurants, shops
 - Long Island with new pier, small visitor center, exterior exhibits at Fort Strong, beach facilities, bicycle paths
 - Deer Island with small visitor center, exhibits
 - Visitor center on Spectacle would be largest; feature an "attraction" such as a multimedia presentation

ALTERNATIVE C, THE PREFERRED ALTERNATIVE

NO-ACTION ALTERNATIVE

Same as Alternative A

Same as Alternative A

- Improvements to facilities emphasize resource protection with accommodation of visitors in concentrated areas
- Primary hubs at George's, Spectacle, Peddock's. Secondary hubs at Long, Deer. Level of infrastructure development reflects size of hub
- Examples of possible changes:
 - rehabilitated and adaptively re-used Fort Andrews on Peddock's as conference center
 - attractions on Peddock's for day visitors
 - redesigned entrance at George's, with rehabilitation of visitor center and historic landscape
 - restoration of selected missing features of Fort Warren
 - Long Island with new pier, small visitor center, exterior exhibits at Fort Strong, beach facilities, bicycle paths
 - Deer Island with small visitor center, exhibits

- Development continues in independent fashion from agency to agency depends primarily on funding availability
- Planning for development continues separately by each agency or organization

ALTERNATIVE A

Costs

- Alternatives suggest conceptual-level potential changes, thus costs are approximate, for long-range planning not short-term budgeting

Capital Costs

- Upwards of \$61 million
- Gateway development range from \$4 million to \$20 million
- Special initiative on Peddock's in collaboration with private sector upwards to \$16 million (see Appendix)
- Studies and research approximately \$4 million

Operating Costs

- Approximately \$8 million.

Funding

- Funds come from all Partnership members except Advisory Council
- Federal funding provided in ratio of one-to-three, federal-to-nonfederal dollars
- Successful implementation of GMP contingent on increased financial contributions from private sources, raised primarily by Island Alliance
- Private funding expected from philanthropic and park-related revenues, use fees, income from commercial operations
- Public agencies expected to fund large infrastructure projects throughout the park
- If revenues are generated each island owner uses revenue first to maintain its own island operations
- Revenue potentially from sales in visitor centers, gateway areas, equipment rentals, interpretation or recreation programs, boat excursions, food sales, events such as concerts
- State legislation necessary for creation and retention of fees by state and local agencies and for long term leases

Boundary Adjustment

- Boundary expanded to include Nix's Mate, Shag Rocks, Snake Island, Webb State Park
- Total acreage less than two one-hundredths the size of existing Boston Harbor Islands national park area
- Each site topographically similar to and proximate to other islands; each contains resources related to park's purpose and which should be protected
- All owners support inclusion of these sites; none to be purchased
- Nix's Mate, a channel marker, site of sea lore; maintained by Coast Guard as channel marker
- Shag Rocks, 1.3-acre cluster of bedrock ledges east of Little Brewster; bird nesting areas; physically inaccessible but visually prominent from other Brewsters
- Snake Island, largely inaccessible eight-acre island in Winthrop containing mud flats and rich bird habitat; owned by Town of Winthrop
- Webb State Park, 15.5-acre site on peninsula between Back and Fore rivers in Weymouth; contains one drumlin, gravel beach, meadow, small scrub growth, trails, small parking lot; DEM acquired in 1977 to be part of its Boston Harbor Islands properties; former Nike missile site; approximately 50,000 visitors per year

ALTERNATIVE B

Same as Alternative A

- Upwards of \$88 million
- Gateway development range from \$4 million to \$20 million
- Special initiative on Peddock's in collaboration with private sector upwards to \$57 million (see Appendix)
- Studies and research approximately \$4 million

- Approximately \$8 million

Same as Alternative A

Same as Alternative A

ALTERNATIVE C, THE PREFERRED ALTERNATIVE

NO-ACTION ALTERNATIVE

Same as Alternative A

- Upwards of \$79 million
- Gateway development range from \$4 million to \$20 million
- Special initiative on Peddock's in collaboration with private sector upwards to \$56 million (see Appendix)
- Studies and research approximately \$4 million

- Approximately \$8 million

Same as Alternative A

Same as Alternative A

Capital costs calculated in the short term; no long-range plan guides all the agencies and organizations

- Between 1970 and 1994, the Commonwealth expended approximately \$25 million in acquisition and capital improvements to the state park

- Cumulatively, agencies and organizations of the Partnership would continue operating costs of \$3 to \$4 million.

- Funds from individual agencies and organizations for use in their respective areas
- NPS and private funds minimal

No changes to boundary

ENVIRONMENTAL IMPACTS

IMPACTS ON NATURAL RESOURCES

CLIMATE

No impacts to climate are anticipated with adoption of any of the alternatives.

AIR RESOURCES

Auto Emissions

Ferries depart from three locations now. Some auto-related exhaust is associated with visitors driving to and parking at these locations. The type of exhaust will include oxides of nitrogen and sulfur, which contribute to the ozone load in the air basin. Ozone standards are already exceeded in this air basin. Under all alternatives there would be an increase in the number of visitors to the islands and thus an increase in auto emissions. Alternatives B and C would have more visitors than Alternative A and thus potentially more cars being driven to departure points.

In Alternatives A, B, and C, instead of three mainland gateways, 14 gateways are possible. This would likely increase the total emissions to the air basin from auto exhaust. However, some visitors may drive shorter distances because more departure options are available. Impacts could be partially mitigated because of this, and further reduced because by the park management's encouraging the use of public transportation to gateways.

Watercraft Emissions

Passenger ferries operate from May to October to George's Island, with water shuttles to five additional islands from George's. The same emissions as described for cars plus particulates from diesel engines are released from ferries and water shuttle boats. In Alternative A additional visitors and additional passenger ferry, water shuttle, and boat excursions would be expected. In addition, to protect island resources, some programs would be conducted on-board vessels. Emissions from this additional boat traffic would add to the load of criteria pollutants in the Boston air basin. In Alternative B, ferries and water shuttles would run frequently, allowing visitors to island-hop. Excursions with rangers would also be available. This alternative also has facilities spread out over many more islands than other alternatives, encouraging visitors to use boats to access them, and thus is likely to have the greatest concentration of boat-related air emissions. Because Alternative C encourages visitors to plan ahead, the amount of

between-island boat hopping is likely to be less than in Alternative B, and has initially more concentrated development at fewer sites. This is likely to result in less boat-related air emissions than Alternative B. Since programs are conducted more frequently on land, rather than on boats, it may also have fewer boat-related emissions than Alternative A. The no-action alternative would have the lowest level of emissions since fewer islands would be open for fewer visitors than in the action alternatives and there would be less use of water transportation.

To the extent that visitors or park staff use scheduled public boat transportation, boat emissions would be mitigated. Also, well-maintained vessels would reduce emissions.

Facility Construction and Maintenance

Air emissions from construction of trails, staff housing, campsites, etc. from heavy equipment would be similar to those from cars or boats. These emissions would be temporary and exist only during the life of the construction. However, during this time, park visitors, especially those with respiratory ailments, may feel effects from ozone levels at or below federal standards (0.12 ppm). Dust from clearing and excavating building sites, building trails, stabilizing historic sites, or removing deteriorated structures would also contribute temporarily to particulates in the immediate area. Because these particulates are heavy, they would fall out quickly. Visitors to the islands where construction is ongoing may experience respiratory irritation, sneezing, etc. from dust. Best management practices, such as watering sites, would reduce air emissions of dust. Current commuter traffic to public health services and police and fire training causes some small emissions of car-related pollutants. Trail and campground maintenance may raise an unmeasurable and temporary amount of dust.

Significantly more construction of facilities would be required to implement Alternative B than Alternative A or the No-action Alternative. This could result in greater quantities of engine-related emissions. Alternative B also includes more clearing and excavating for trails, shelters, construction of piers and boat moorings, visitor centers, administrative facilities, and infrastructure not occurring in Alternative A which would increase dust beyond that in Alternative A.

Under Alternative C less development would occur on several islands than in B but more development of hub islands than in A, likely resulting

in emissions intermediate between Alternatives A and B, but closer to B than A. Development would also be initially concentrated on George's and Spectacle, with development of other hubs if ferry-service demand warranted it. Emissions would likely therefore occur at lower concentrations over a longer period of time than if Alternative B were selected. This is true both of equipment-related emissions and particulates from excavating and clearing construction sites.

GEOLOGY AND COASTAL PROCESSES

Several of the islands have experienced alterations of their coastlines, or even, in the case of Spectacle Island, their geology. Spectacle Island was originally two drumlins connected by a sandbar, but has been altered significantly by landfilling. Others, such as George's, Great Brewster, Long, and Moon, had military or other facilities built onto the island's edge and now require retaining walls or riprap to absorb the impact of waves and stabilize the coastline. Islands are subject to the natural flow of currents around the island, and therefore the natural cycle of erosion or deposition of sand and gravel. Thus even the No-Action Alternative would have impacts as a result of coastal processes.

Alternative A places more of the islands in management areas with natural resources emphasis than the others, and encourages actions to preserve or restore natural processes. As an example, sea walls that are not themselves cultural resources would be allowed to wash away unless they protect an important cultural resource. This commitment to the return of natural landscapes could result in the return of natural coastal processes in these cases. Piers or moorings to allow visitors onto the islands would be minimal compared to Alternative B or C, but formalized, handicapped-accessible piers would be added to several islands where they do not exist now. Each of these structures in the coastal zone has the potential to alter the flow of currents and sand, which could disrupt the natural coastal processes of depositing sand or rocks. Some boardwalks and trails along beach or mudflat or salt flat areas would be built. If natural vegetation that normally holds sediment in place is removed, beaches or mudflats or salt flats could be washed away.

Alternative B includes a higher percentage of management areas that allow for development (visitor services and park facilities; managed landscapes, special use emphasis) than Alternative A or C. This means structures such as formalized trails across beaches,

boardwalks in salt marshes, boat moorings, piers, etc. would likely be built on more islands. This alternative also includes fewer islands where natural features emphasis zoning would occur. It is likely that ongoing unnatural erosion would continue, and that some new sources of beach erosion may take place if these new structures are not planned with coastal processes in mind. Encouraging visitor access and use of beaches and coastal areas of many of the park's islands may also result in trampling or removal of coastal wetland or dune vegetation now holding sediment in place, resulting in its erosion.

In Alternative C, as with Alternatives A and B, boardwalks or trails built across beaches or coastal wetlands, piers, trampling and erosion of vegetation, and the restoration of natural erosion and deposition processes could all affect coastal processes. This alternative has slightly less large-scale development planned than Alternative B, and it would proceed as demand warrants it. Also, a few islands would contain areas of natural features emphasis—the same as in Alternative A and be more protected than in Alternative B. For these reasons, impacts to coastal processes in this alternative would be greater than in Alternative A, but less than in Alternative B.

WATER QUALITY

Water quality in Boston Harbor has improved since 1991; dissolved oxygen is higher and organic toxin levels have decreased. Potential sources of pollution from the islands include wastewater from septic systems, graywater from cooking, washing, etc. and surface flow, which may carry sediment, fertilizers, and herbicides or other chemicals applied to the island. Ferry and shuttle boats also likely leak oil, gas, or diesel fuel on a regular basis, even if they are well-maintained.

In Alternative A, development of facilities requiring grading would cause temporary increases of siltation, as well as washing in of oil and grease leaking from heavy equipment. Use of trails can also add sediment during storms. This alternative also includes some new toilet facilities, as well as lodging, campsites, and staff housing—all of which mean additional wastewater would be generated. Through the use of best management practices, siltation and leaks can be contained. Composting toilets can eliminate or greatly reduce the threat of septic releases. The release of graywater is likely to be insignificant if piped to deeper water.

Adopting Alternative B would result in greater development of the islands, and temporary oil and grease leaks or increases in siltation from excavating or clearing to build facilities could be greater than in Alternative A. Increases in staff housing and park maintenance facilities could increase wastewater releases or oil and grease from maintaining boats or equipment on site.

As with other development-related impacts, the impacts under Alternative C to water quality from oil and gas leaks from equipment, or siltation from excavating and clearing, would be intermediate between Alternatives A and B.

SOILS

Soils have been removed, compacted, and in some cases supplemented to build existing facilities on several of the islands over the centuries, including the wastewater treatment facilities on Deer Island, military facilities on George's, Lovell's, Peddock's, and Long, city services on Moon and Long islands, and the landfill on Spectacle Island.

Under all alternatives, increased use of islands with friable soils will cause loss of soil due to foot traffic. Development will disturb soils, compact soils, and disturb native vegetation, making disturbed areas vulnerable to colonization by exotic plants. In Alternative A the impact is not significant and can be partially mitigated by clearly developed and marked trails. In Alternative B the extent of soil loss and compaction would be greatest, as facilities are planned over a wider area and on more islands than in other alternatives. Loss and compaction of soils may be less extensive in Alternative C than in Alternative B, unless visitor demand increases to the point that other hubs are developed. If this occurs, impact to soil of full "build-out" of this alternative would be comparable to that in Alternative B.

UPLAND VEGETATION

Native Vegetation

Few stands of forests exist today on the islands. The primary vegetation is grasses and shrubs such as blackberries, raspberries, bayberry, poison ivy, and beach plum. Although some of these are not native they do hold soil in place and provide wildlife food and shelter. Control of exotic plants or management for ecosystem or habitat restoration does not currently exist for the islands.

Trails and interpretive signs are planned in Alternative A for all of the islands where mature or

successional native forests exist. Most of these islands already have trails and camping; if new or modified trails associated with this alternative are located correctly, no or only minimal impact to forests would occur. Under Alternative B, trails and interpretive signs, campsites, visitor contact stations or visitor centers, maintenance facilities, staff housing, rental facilities for fishing and water sports, lodging, and sale of park-related items may be located on the islands where stands of native forest exist. Without careful planning in locating these facilities, the forest stands may be removed or reduced from their present extent. In addition, the presence of additional visitors, especially campers, could result in accidental burning or use of trees for firewood. In Alternative C, of the islands where native forest vegetation occurs, some would have development similar to Alternative A and the others similar to Alternative B. This means some campsites and park facilities would not be built, and the chances of impacts through removal or accidental burns of forest stands is slightly less likely than in Alternative B.

Vegetative Cover/Exotic Species

Under Alternative A, development of trails, campsites, or facilities would remove vegetation and increase the potential for loss of soil or wildlife habitat. However, this alternative includes the most acres placed in natural resource emphasis. Actions in this management area include the control of exotic plants, habitat or species restoration, and ecosystem restoration. These actions would favor the return of native plant species and the loss of exotics from the mix of upland vegetation covering the islands now. Alternative B involves more development of the islands than Alternative A, and additional non-native vegetation would likely be removed as a result. It also has fewer acres in the natural features management area. Because island vegetation is not managed to eliminate exotics or return native species unless it is in the natural features management area, this alternative may result in some small improvements compared to No Action, but have less advantages for native vegetation than Alternative A. Alternative C would involve less development on islands that are now in a natural or semi-natural state than Alternative B. It also includes some islands placed in natural features emphasis which are subject to additional development as "managed landscapes" in Alternative B. Therefore the amount of vegetation removed would be less than in Alternative B, and the likelihood that native species would return would be greater than in Alternative B or No Action.

WILDLIFE

Birds

The islands are host to many shorebirds, gulls and cormorants, waterbirds, and nesting neotropical migrant species. Upland species, such as pheasants, hawks, owls, and songbirds, occupy areas vegetated with trees and shrubs. Wetland species, such as herons, ibis, and egrets, are found near freshwater or shallow brackish or salt marshes. Shorebirds such as oystercatchers, terns, and sandpipers occupy rocky and sandy beach areas. Herring gulls, cormorants, and sea ducks live either at sea or on the rocky intertidal shores. Special bird habitat or communities on the islands include those for heron rookeries, nesting gulls, common and red-throated loons, and particularly good upland bird habitat in berry thickets. Since surveys have not been performed, other unusual bird habitat may exist. Building beach trails or boardwalks would disturb and displace shorebirds and some wetland species. Development generally would remove habitat that is likely to be occupied by some species of birds. However, in natural resource management areas, habitat may be created which would support native bird species.

Existing nesting habitat would be well protected in the natural resources management area, which covers the largest extent in Alternative A. Additional development of islands for visitor use in Alternative B would remove habitat and increase disturbance. Visitors would be spread out over more of the islands than in other alternatives, causing birds sensitive to human disturbance to move or leave the islands. Overall, Alternative B is likely to have a greatest adverse effect on birds. Under Alternative C the concentration of visitors would be greater on hub islands than in Alternative A, but lower on some of the other islands than in Alternative B. This would likely reduce impacts to birds, since they are already disturbed in areas where facilities would be focused. However, if visitor demand results in the development of two secondary hubs, impacts to birds could be similar to those described for Alternative B.

Mammals

Rabbits, raccoons, skunks, squirrels, mice, muskrats, and Norway rats roam the islands. No comprehensive management of these species occurs on the islands now. Development has removed habitat for some of these mammals. Non-native or feral species may have been introduced inadvertently by visitors or those using the islands. Control of exotics and the

restoration of native species and habitat are actions in management areas of natural resources emphasis.

Alternative A has the largest acreage of this type, and so could result in elimination of non-native mammals. It also has the least area proposed for development and the fewest visitors on the islands. These factors would mean it would create the least displacement and disturbance of the action alternatives. Alternative B would likely remove the greatest amount of habitat used by terrestrial mammals on the islands and create the most disturbance through noise and the presence of human activity. The impacts of Alternative C would be similar to those of Alternative A initially. However, if visitor demand increases, additional hub islands would be developed and some wildlife habitat removed in those areas.

WETLAND AND AQUATIC MARINE VEGETATION

Seagrass Beds

Eelgrass is the last remaining type of seagrass in Boston Harbor. It provides cover and food for a variety of fish, as well as filtering suspended solids from the water column. It is considered a critical wetland component for many commercial fish species. Although it was once plentiful, it is now present in only three areas. Several small patches occur between Bumpkin Island and World's End. Although it normally occurs in water less than two meters deep, it occurs in deeper water off Bumpkin Island because the water is clear, and light can penetrate deeply.

Under Alternative A turbidity associated with increased boat traffic or trail use could eliminate deeper-water patches of eelgrass off Bumpkin Island. A pier could directly eliminate some of the eelgrass, or could increase turbidity and pollution during construction. Releases of wastewater high in nitrogen (typical of septic systems) could eliminate eelgrass, as it is sensitive to nutrient loading. Composting toilets, and the careful location of the pier away from the south of the island, would mitigate impacts to the eelgrass. In Alternative B Bumpkin Island would have potentially more campsites, a larger visitor contact station, maintenance and staff facilities to handle more visitors and more boat trips. This could mean increased septic outflow on Bumpkin Island. Sediment may be washed into the water during construction of these facilities as well. All would increase the probability that eelgrass would be adversely affected. The effect could be significant unless facilities are sited carefully and other mitigation measures (such as

composting toilets, BMPs during construction) are used. The facilities planned for Bumpkin in Alternative C are the same as in Alternative A. The impacts to eelgrass would be the same as described in Alternative A.

WETLAND AND AQUATIC MARINE WILDLIFE

Invertebrates

Many species of clams, mussels, scallops, oysters, and crabs occupy the intertidal zone—both on rocky shores and in mud or salt flats of the islands. They provide food for shorebirds, mammals, and humans. It is likely that development of the islands has adversely affected habitat for these invertebrates, and that the proposed development that would occur under any of the alternatives would further this effect through siltation, direct removal of beds (to create piers, for instance), and access by visitors who may dig clams, catch crabs, etc.

In Alternative A the actions that might adversely affect intertidal invertebrates include providing visitor access; beach trails, piers, and boardwalks that remove habitat; boat traffic or trail use that increases turbidity, and construction which may increase siltation for a temporary period of time. Alternative A has less than Alternatives B or C of each of these except boat traffic, which may include presentations of programs from boats instead of onshore. If these programs are conducted well away from the shore, no impacts are expected to intertidal invertebrates from them. Alternative B has a greater potential to adversely affect these species, since it includes many more piers to provide access and developed facilities on more islands. This spreads access and the impact of visitors over more of the islands. This alternative also includes more overnight lodging facilities and campsites than Alternative A or the No-Action Alternative. Alternative C would probably have less impact to intertidal invertebrates than Alternative B, but more than Alternative A, at least in the short term. If visitor use increases, access to other islands will be created and populations of these species will experience impact.

Fish

Sport fishing, including fishing contests, is more numerous than had been the case before Boston Harbor was cleaned up.

The impacts on fish would be much the same in all alternatives. It is unlikely that the degree of fishing pressure from island visitors would have more than a negligible or minor impact on fish population size or

health in the area even though some alternatives would have fewer piers than others.

Mammals

Seals, including hooded, harp, and ringed seals, sometimes use the rocks of the outer islands to haul out. Marine mammals, including several species of whales and dolphins, feed and migrate through the area, and Stellwagen Bank east of the harbor is an important nursery and feeding ground for humpback, fin, and Northern right whales.

Increased boat traffic associated with all action alternatives may pollute ocean water slightly with oil, grease, and black or graywater releases. Engine noise may also disturb marine mammals. These actions are expected to have only negligible impacts on dolphins and whales. Increased visitor activity or boat docking may disturb seals if it is in the immediate vicinity. Alternative B includes access to more islands and more visitor services such as trails and campsites. This increase in human activity along the coast could result in disturbance to seals. In Alternative C the impact of human activity would be intermediate between Alternatives A and B.

PROTECTED PLANT SPECIES

State listed plant species are Sea-beach Dock and American Sea Blite, which occur on five islands. Trails and interpretive signs are planned in Alternative A for all of the islands where protected plants are known to occur. Larger-scale facilities, including park facilities, staff housing, campsites, and a cultural center, may be built under a special initiative on Peddock's. Surveys to locate all patches of Sea-beach Dock will be required before development of these facilities can begin. Parts of Thompson and Peddock's and all of Langlee island are in the natural resources management area. Closing these areas to public use, or restoring habitat so these species can expand, are both possible. More development may take place on these islands in Alternative B than in Alternatives A or C. In addition, portions of Peddock's Island and all of Langlee would not be in the natural resources management area. Development on Peddock's could include a visitor center, lodging, and sales items. Impacts could be mitigated by surveying, avoiding building on populations of these plants, and posting signs or otherwise keeping visitors from trampling them. Under Alternative C impacts would be intermediate between Alternatives A and B, with Langlee in natural resource area and no development

proposed. Where development could occur (on the other islands), surveys and avoidance through relocation of facilities, trails, and signs for visitors would prevent impacts.

PROTECTED BIRD SPECIES

Least Tern

The Least Tern is a waterbird that eats small fish or aquatic invertebrates. It nests on sandy beaches or gravel bars, and has been seen on Lovell's and Rainsford islands. This species is listed as one of special concern in the state of Massachusetts.

In Alternative A the development and use of boardwalks or beach trails on Lovell's and Rainsford islands could increase human access to and therefore disturb nesting least terns. Impacts from development would remain nearly the same for Rainsford Island as in Alternative A but would increase on Lovell's, as campsites and staff housing are added as proposed. Under Alternative C development on Lovell's would be the same as in Alternative A, and on Rainsford the same as in Alternative B. Impacts to the tern in this alternative would be intermediate between A and B overall.

Northern Harrier

The Northern Harrier hawk species listed as threatened by the state, has been known to inhabit Grape Island. Harriers occupy open fields and hunt small rodents.

Proposed development of Grape Island includes trails, staff housing, and shade shelters. If these are sited to avoid the area where these birds are roosting or hunting, the Harrier may not be affected. Alternative B includes campsites, administrative facilities, and maintenance facilities on Grape Island in addition to those described for Alternative A. The chances that individuals Harriers would remain and hunt on the island with increasing human activity are low unless their feeding and roosting area can be closed to campers and hikers, and no development located there. The development proposed for Grape Island in Alternative C is the same as for Alternative A. Impacts to the Harrier would also be the same.

Common Tern

The Common Tern is a larger relative of the Least Tern that can occupy lake or ocean bay islands or beaches. It has been found on Long Island. It is listed as a species of special concern by the state.

Alternative A proposes additional public access on Long Island, and park visitors might stroll along

beaches; boardwalks or trails. Such trails or boardwalks could disturb terns, which may fledge fewer young or leave nests. In addition to trails, boardwalks, and a pier, Alternative B envisions beach facilities, staff housing, a visitor center, and rental facilities for water sports. This level of beach-oriented development is likely to eliminate tern nesting, unless it is carefully located to avoid the terns, and the tern nesting area is closed to public access. In Alternative C the level of proposed development would be comparable or slightly higher than Alternative A.

Barn Owl

Barn owls occupy woodlands, groves, fields, and farms. They nest in hollow trees or airy abandoned buildings or barns, and have been sighted on Deer, Thompson, George's, and Lovell's Islands. This is a state-listed species of special concern.

No new development on Deer or Thompson islands is proposed in Alternative A, and changes to George's Island would probably not disturb barn owls as the focus would be on pier improvements. However, changes at Lovell's, including construction and adaptive re-use of historic structures or removal of deteriorated structures, may disturb nesting or roosting barn owls. Under Alternative B, in addition to changes described in Alternative A, changes would include proposed campsites and park facilities. If these are located away from the successional forest where barn owls may be nesting or roosting, impacts could be minimal. However, campsites or staff housing in the forest could remove habitat and cause permanent disturbance from human presence. In Alternative C, impacts would be similar to Alternative A on Lovell's Island.

SPECIAL COMMUNITIES OR HABITATS

Freshwater Wetlands

Areas on the islands that are permanently covered or inundated for much of the year with shallow freshwater are rare. A perennial pond occurs on Thompson Island, freshwater marshes occur on Long and Middle Brewster islands. These wetlands are productive communities that provide habitat, food, and nesting space for a variety of fish and birds.

Thompson and Long islands would be somewhat developed with trails and toilets in Alternative A. Some of these trails may be boardwalks that deliberately ring or impinge on wetland areas so that visitors may observe the greater abundance of wildlife. The construction and use of trails or boardwalks in or

around wetlands may disturb or even displace nesting birds. It may also remove vegetation or require filling to place boardwalk pilings. The filling of wetlands would require approval by the municipality under the state wetlands protection law, and by a special division of the NPS, as well as a permit from the U.S. Army Corps of Engineers and additional NEPA compliance.

In Alternative B Long Island may have more extensive boardwalks than in Alternative A. The construction of large facilities, such as a visitor center, lodging, or a cultural center, could either result in the removal of wetland vegetation (if permissions were obtained) or increased siltation or nutrient loading through septic failure. Increased visitor use could disturb or displace wetland birds. Adopting Alternative C could eventually mean the development of a secondary hub at Long Island, thus additional facilities such as campsites and administrative facilities. The additional human presence, as well as construction noise and the chance of siltation of wetlands, means Alternative C may have greater impacts on this resource than Alternative A.

Tidal Flats

Sand and mud flats provide habitat colonized by benthic (bottom-dwelling) invertebrates, such as clams and crabs. Some grow algal mats, which provide habitat for plankton and can act as a nursery for crabs, small fish, or larval clams. They are highly productive coastal wetlands, and support a variety of fish, birds, and invertebrates, as well as dampen the effect of wave action, particularly in a storm. Mudflats are found on Raccoon and Snake islands.

No change to existing conditions is proposed to either Raccoon or Snake Island in any alternative. At the present time, access to the 3-acre Raccoon Island is by private craft only, and visitors are discouraged from accessing the 11-acre Snake Island.

Salt Marshes

Eventually, a mudflat fills with sediment and salt marsh plants become established. These highly productive ecosystems are dominated by saltwater cordgrass, a species that provides cover and nursery habitat for a variety of fish and shellfish. Sediments are rich organics that provide burrowing worms and other invertebrates with abundant food. Larger salt marshes on the islands occur on Thompson Island (50 acres) and Snake Island (5 acres). Smaller brackish marshes exist on Calf, Gallop's, Grape, Lovell's, and Peddock's. Much of the original salt marsh and wetland area on the

south end of Thompson Island has already been diked and drained for agriculture.

All alternatives propose the addition of some trails and small-scale visitor facilities for Thompson Island. If these are sited in or near the marsh, it may result in the removal of habitat, or the disturbance and displacement of birds or invertebrates. No changes are planned for Snake Island in any alternative.

Alternative A calls for increased access via piers and trails to the remaining islands where coastal marshes exist, with the exception of Calf Island. If sited in or near salt marshes, these facilities may increase disturbance or siltation, which would degrade the quality of the marsh for wildlife. Significantly greater development on all islands, except Snake and Thompson, would occur under Alternative B than under any other alternative. The small salt marshes of these islands could be highly sensitive to the higher levels of visitor use. Campers or day-use visitors hunting crabs or fish could reduce populations, and trampling could collapse the banks holding brackish water or eliminate vegetation. This would lead to increased erosion, increased turbidity, and reduced habitat. Impacts under Alternative C would be the same as under Alternative A.

Rockweed and Barnacle Communities

These communities characterize rocky outcrops or manmade structures within the tidal range. They support lichens, barnacles, and other gastropods on which seabirds feed, as well as algae and seaweed. Tidal pools in this zone also support a variety of marine invertebrates, including mussels, snails, starfish, crabs, sea anemones, and horseshoe crabs. They exist on Brewsters and other islands of rock outcrops. These communities are easily impacted by intensive use. Significant numbers of people walking on the rocks can virtually eliminate all life forms in these communities by crushing and trampling the plants and animals that live there.

The outer islands would be in the management area for natural resource protection under Alternative A and would remain as inaccessible as they are now; therefore significant impacts to this community are not expected. Under Alternative B, Great Brewster and Little Brewster would both be developed with piers, and visitor amenities. Providing visitor access to these islands is likely to result in the destruction of a part of their rocky intertidal communities. Impacts under Alternative C would be similar to those of Alternative

B as long as visitors are allowed on islands and facilities introduced for their benefit.

Barrier Beaches

Barrier beaches separate freshwater or wetland systems from the ocean and are protected by several laws. They have been identified on Great Brewster, Gallop's, Peddock's, Bumpkin, Long, Rainsford, and Thompson islands.

Trampling of barrier beach vegetation causes increased erosion and eventual blow-outs of barrier beaches, with resulting loss of function in separating salt and fresh water. Non-vegetated dunes on barrier beaches (and elsewhere) are much more resistant to significant physical impacts from visitor use (since the sand tends to move freely anyway, visitors walking/sliding on the dunes are usually not a significant factor).

Increased visitation to Bumpkin, Gallop's, Long, and Thompson islands proposed in Alternatives A and C may result in blow-outs and erosion of these natural features. In Alternative B, significantly greater development of the islands for visitors, as well as access to Great Brewster and Rainsford in addition to all other islands on which barrier beaches have been located, is likely to result in trampling of vegetation and loss of barrier beach function in some cases. Mitigating measures, such as fencing, could be implemented in all alternatives.

Dunes

Dunes are fairly unusual on the islands. They may provide protection from wind or wave action, particularly when stabilized by vegetation. They occur on Lovell's and Long Islands.

In Alternatives A and C, trampling of vegetated dunes could subject them to severe damage. Access and trails, including boardwalks, are planned for both islands where dunes occur in this alternative. Trails or boardwalks across dunes could remove vegetation or the dunes themselves; increased visitor use could also result in the damage or destruction of dunes. In Alternative B, beach facilities, shade shelters, rental facilities for water sports, and other beach-oriented development proposed for Long Island, as well as campsites and park facilities proposed for Lovell's Island in this alternative, could result in destruction of dunes directly if facilities are sited on them, or through increases in trampling from visitors.

IMPACTS ON CULTURAL RESOURCES

BUILDINGS and STRUCTURES

The park has more than 100 structures, including forts, lighthouses, institutional buildings, cottages, and gun emplacements. Except for the National Historic Landmarks, National Register properties, and several notable other buildings, the structures have not been evaluated for their historical significance.

Under all alternatives, historic structures would be treated according to the Secretary of the Interior's standards for historic preservation. Under Alternative A the preservation of historic structures and their environments would be maximized relative to the other alternatives. Beneficial impacts would be limited to areas managed with an historic preservation emphasis, including protected and eligible properties for the National Register of Historic Places.

Preservation efforts directed toward individual or isolated groupings of buildings and structures outside of the broader geographical, historical, and interpretive contexts of the entire area may have an adverse impact on the historic integrity of non-targeted resources and on the area's cultural resources, when viewed as an integrated system. Emphasis placed on the rehabilitation of some historic structures and the encouragement of recreational exploration of historic ruins may have an adverse impact on some cultural resources that are currently in fragmented form. With Alternative B the rehabilitation of some historic buildings and structures would stabilize deteriorating cultural resources, but increased traffic could outweigh the mitigating effects of the proposed actions. Buildings and structures within areas designated for a managed landscape emphasis may be adversely affected by high visitation and extensive recreational use of island resources. Impacts under Alternative C would be similar to those described for Alternative A. Under the No-Action Alternative, few areas of the park would receive the funds necessary to bring buildings up to standards for visitors, and thus they would deteriorate further. Visitors would be either prohibited or discouraged from areas where structures are in poor condition and cannot be stabilized.

CULTURAL LANDSCAPES

By their nature, cultural landscapes are altered by humans. On the Boston Harbor Islands the numerous varied types of cultural landscapes (historic vernacular, ethnographic landscapes, historic designed landscapes)

are unevaluated for their historic significance. They are found on most islands. The Secretary of the Interior's Standards for Historic Preservation would be used in prescribing treatments.

Under Alternative A the restoration of some landscapes and the management of non-native vegetation might adversely affect some cultural landscapes because some exotic plants may be important or significant features. Minimal trail development, directed activities, and low-end visitation would reduce potential adverse impacts to the islands' cultural resources. With Alternative B, emphasis on open-ended and unstructured visitor experiences and the extension of visitor services and park facilities to additional islands and interior locations would have an adverse impact on unidentified and unprotected cultural landscapes. Facilities for anticipated high visitation, such as trail development and the removal of non-native plants, would adversely affect some cultural landscapes. Excavation and construction for major visitor facilities may have an adverse impact on cultural landscapes and may put natural and cultural resources to recreational uses not specifically related to the resources rather than for important or significant historic land use patterns. Alternative C impacts would be similar to those of Alternative A. The No-Action Alternative would have higher impacts than A or C but a lower level than B.

ARCHEOLOGICAL RESOURCES

Most, if not all, islands have actual or potential prehistoric or pre-contact sites, according to archeologists. Archeological resources, many of which are found in shell middens, include remains of food and other waste, tools, and bones. Construction for facilities, new plantings, trail improvements, and virtually anything that requires disturbance of the soil can affect archeological resources. Under state and federal regulations, archeological resources are protected. Prior to disturbance of the soil, an investigation is done to ascertain the presence of archaeological resources. Mitigation measures are taken for known sites. Investigations can cause delays in construction schedules and may increase construction costs.

In all alternatives, archeological resources will be identified through systematic surveys. With more information about the types of resources present and their locations, sensitive sites can be avoided or mitigation begun well in advance of soil disturbance.

ETHNOGRAPHIC RESOURCES

Ethnographic resources are associated with ethnic or traditionally associated groups that occupied the Boston Harbor Islands—certainly American Indians, and perhaps Irish, Portuguese, military families, fishermen, farmers, lighthouse keepers, and others. Research remains to be done to determine the extent of ethnographic sites on the Boston Harbor Islands. Since ethnographic sites are generally unknown, protection is ad hoc, and impacts from the alternatives cannot be determined.

MUSEUM COLLECTIONS

A substantial museum collection comprises more than 6,000 items and is housed among more than a dozen organizations. The collection includes archeological, archival, historical, and natural history objects in a variety of print and nonprint formats.

Under all alternatives, collections management would continue to vary depending on the managing agency. There will be no central repository. In Alternatives A, B, and C collections would continue to be maintained by various agencies at NPS standards, and the NPS would maintain a central database.

SOCIOECONOMIC IMPACTS

The Boston Harbor Islands are known for attracting a broad cross section of the population, from international tourists to inner-city school children. All the alternatives have similar positive impacts on the sociological environment. In terms of economy, the following impacts might be expected, based on the application of the NPS "money generation model." With visitation currently at approximately 150,000 per year, an estimated \$9 million in income, \$1.5 million in tax revenue, and 330 jobs are generated to the local economy.

If the islands are developed at a low-to-moderate level as Alternative A suggests, with docks, improved sanitation, and other visitor facilities, and approximately 200,000 visitors annually, \$12.4 million in income, \$2 million in tax revenue, and 450 jobs might be expected to be generated to the local economy.

Alternatives B and C would have the islands developed more intensively with, for example, more food services, lodgings, camping, equipment rentals, and different types of amusements; at least 400,000 persons might visit the islands each year, which would increase income by \$24 million, add \$4 million to tax income, and add 880 jobs to the area labor force.